PROTECTIVE BREATHING HOOD

FIELD OF THE INVENTION

The present invention is concerned with a protective breathing hood. In particular, the invention is concerned with a protective device collapsible into a pocket-sized article radially available and easily donned for protecting an individual from the risk of inhaling hazardous material, e.g. poisonous gases and biologic material.

BACKGROUND OF THE INVENTION

Protective breathing hoods and masks are well known and a large variety of such articles are available. These are used to ensure safe breathing in hazardous situations in which harmful or deadly gases are generated or at the environment of biologic material, e.g. in the event of fire emergencies, chemical or biological industrial disasters or in case of terror or warfare attacks.

Professional protective breathing equipment is used by professionals such as fire fighters, military units and is also known to be provided to citizens of some countries in which chemical/biologic war threat exists. Such equipment is typically more cumbersome and is used to provide prolonged protection and in harsh conditions.

Recently, there has been ever growing interest in radially available, lightweight, portable protective breathing equipment for use by civilians and which may be easily carried daily, e.g. in a purse, bag or radially stored at office buildings, etc. Such devices are designed for easy donning in case of an emergency, e.g. outbreak of a fire, leak of some chemical substance or in case of a terror attack in

which biological warfare agents such as anthrax germs are spread. In such instances time is a critical factor in survival.

For example, in case of fire breakout in buildings occupying many people such as large office buildings, hotels, and halls, where many people gather simultaneously, it may take a while until the professional teams arrive, e.g. fire fighters, hazardous-material professionals, etc., whereby it is advantageous that each and every person carry with him, or be radially provided with a protective breathing mask.

U.S. Patent Serial No. 4,870,959 discloses a protective breathing mask comprising a fire-resistant stretchable material shaped as a hood for wearing over and enclosing the head, fitted with a visor portion and with filter materials sealingly attached to the stretchable material wherein the filtering material comprises a plurality of fire-resistant flexible layers of material embedding therein activated charcoal particles.

U.S. Patent Serial No. 5,875,775 as a structure which is basically similar to that disclosed in U.S. 4,870,959 with the improvement comprising a one-way respirator adapted for maintaining the mouth and nose spaced apart from the filter portion for efficiently directing breathing efforts to equalize inhalation airflow via substantially all of the filter while the one-way valve eases exhalation airflow and reduces condensation on the interior side of the visor.

It is an object of the present invention to provide a personal protective breathing mask which may be collapsed into a pocket-size package, radially available for use and easily donned to provide a protective breathing device which is affordable and instantly useful in protecting individuals at the event of toxic air, chemical and biologic emergencies.

SUMMARY OF THE INVENTION

It is a primary object of the present invention to provide a protective breathing mask collapsible into a pocket-sized package comprising a hood made of a stretchable fire-resistant material and formed with at least a visor portion and a

pair of respiratory units being in flow communication with a chamber formed when the hood is donned, wherein inhalation compels airflow through an inhalation flow path of the respiratory units and exhalation compels easy airflow through the one-way exhaling valve of the respiratory unit.

In accordance with the present invention there is provided a protective breathing hood comprising a hood made of a stretchable fire resistant material and which is also impermeable to gases and biologic material, said hood sized and shaped for placing over a head of a user in an airtight manner with an opening of the hood sealingly engaging a neck portion of the user; at least a visor portion of the hood is transparent; and a pair of respiratory units disposed offset with respect to the nose location; each respiratory unit comprising a housing formed with an inhalation flow path accommodating activated charcoal particles, and an exhalation flow path fitted with a one way exhaling valve, and wherein in a donned position of the hood a chamber is formed at a mouth/nose location thereof.

According to one embodiment of the present invention, the housing comprises an array of receptacles accommodating the charcoal particles; where each receptacle has an inlet opening and an outlet opening and where at least one of the inlet and outlet opening of each receptacle has a cross-section smaller then a cross-section of the receptacle.

In accordance with a particular embodiment, the housing comprises an array of receptacles defined by partitions extending between a proximal wall corresponding with an inside of the hood, and a distant wall corresponding with an outside of the hood; said receptacles accommodating the charcoal particles; the walls comprising openings corresponding with each receptacle and wherein the openings have a cross-section smaller then a cross-section of the receptacle. This arrangement ensures that inhaled air is compelled to flow through activated charcoal particles.

The chamber formed at the mouth/nose location of the hood may be initially formed while production of the hood, e.g. in a molding process. Alternatively, the chamber may be formed by one or more deforming members which at the donned

state of the hood deform a portion corresponding with a mouth/nose location of the hood so as to project outwardly and form said chamber.

The deforming member may be made of a rigid though pliable material which may comprise one or more integral hinging portions and which is normally biased into a spaced apart position to thereby span and form said chamber. In accordance with one particular embodiment, the deforming member is articulated to both respiratory units.

The activated charcoal particles is in the form of loose material which may be packed within the receptacle or may be embedded within a bedding material (e.g. sponge material or other carrying matrix) or may be impregnated into a charcoal cloth. The activated charcoal particles may also be formed with a suitable carrying matrix in the form of pellets receivable in the receptacles. Where it is desired to provide also protection against biologic material, the respiratory units further comprise a biologic material barrier disposed in the inhalation flow path. Such barrier material may be, for example, bacteriological filter in a paper-like form and the like.

In accordance with one particular embodiment of the present invention the hood is made of silicon material whereby in accordance with one specific design the entire hood is transparent.

In order to ease mounting of the hood on an individual's head, a sealing neck portion of the hood may be plaited whereby extra material is provided so as to increase stretching of the neck portion and to reduce pressure around the individual's neck at the donned position.

BRIEF DESCRIPTION OF THE DRAWINGS

In order to better understand the invention and to see how it may be carried out in practice, some embodiments will now be illustrated in a non-limiting manner, by way of example only, with reference to the accompanying drawings, in which:

Fig. 1 is a side elevation of a protective breathing hood in accordance with the present invention;

Fig. 2A is an isometric view of a protective hood in accordance with the present invention donned, over an individual's head;

Fig. 2B is a partial view sectioned at II-II in Fig. 2A;

Fig. 3A is a front isometric view of a couple of respiratory units articulated to one another by a deforming member;

Fig. 3B is a rear isometric view of a couple of respiratory units articulated by a deforming member;

Fig. 4 is a partially sectioned isometric view, from an inside, of a respiratory unit in accordance with the present invention;

Fig. 5 is an exploded isometric view of a respiratory unit in accordance with the present invention; and

Fig. 6 is a section through a portion marked VI-VI in Fig. 4, also illustrating gas flow through the respiratory unit.

DETAILED DESCRIPTION OF THE INVENTION

Attention is first directed to Figs. 1 and 2A of the drawings illustrating the protective breathing hood generally designated **10** which in Fig. 1 is in a flat position and in Fig. 2A is illustrated donned over an individual's head **11**..

The protective hood **10** comprises a hood **12** made of a stretchable fire resistant material, e.g. silicon rubber which may resist heat up to about 400°-600°C and which is an extremely elastic material whilst being impermeable to gases and biologic material.

The hood **12** has an opening **14** through which the head of an individual is introduced and a neck sealing portion **16** which as illustrated in the figures is plaited at **18** so as to allow good sealing engagement about the individual's neck (see Fig. 2A) whilst not choking the individual or causing an uncomfortable feeling. The arrangement is such that when the hood is donned over a user's head

the sealing portion **16** sealingly engages about the user's neck preventing ingress of obnoxious gases or biologic material therethrough.

As can further be illustrated in Figs. 1 and 2A, the protective hood **10** further comprises a visor **20** which in the present example is a uniform translucent portion extending over both eyes made of a material which is also a heat resistant material.

However, it is to be appreciated that the visor **20** may be formed in other shapes and forms, e.g. two eye pieces extending opposite the eye locations of the hood or, the arrangement may be such that the entire hood **12** may be transparent and accordingly no particular visor is provided.

The protective hood **10** is formed with two respiratory units **26** disposed offset with respect to the nose/mouth location of the individual, indicated in the figures at **30**.

The intersecting dashed lined marked **F** in Fig. 1 indicate a fold line about which the hood may be folded and may be preserved in a sealed, pocket-sized package other folding patterns are possible as well.

One other important character of the invention noticed in Figs. 1, 2A and 2B is the deformation of the hood at the nose/mouth location giving rise to forming an internal chamber **C** (see Fig. 2B) between the nose/mouth location **30** and the individual's face, the purpose of which will become apparent hereinafter. However, it is noticed that the chamber **C** renders respiratory units **26** to be is in flow communication with the nose and mouth of the individual.

Turning now to Figs. 3A and 3B, there are illustrated a pair of respiratory units **26** articulated to one another by a supporting member **38**. The particular structure of the respiratory units **26** is disclosed hereinafter in detail with reference to Figs. 4-6.

In the particular embodiment (Figs. 3A and 3B), deforming member **38** is made of a rigid plastic material formed with two ring-like portions **40** clampingly secured to each of a pair of respiratory units **26**, with an intermediate bridging portion consisting of two members **42A** and **42B**, though other constructions are

possible as well and which at the assembled position, while donned over an individual's head, extend at the nose/mouth location to thereby deform the hood **12** giving rise to forming chamber **C** (see also dashed lines in Figs. 1 and 2A). Bridging portions **42A** and **42B** are interconnected to the circular portions by integral hinges at **44**. For the sake of clarity, the supporting member **38** is illustrated also in Figs. 1 and 2A, by dashed lines.

Whilst in Figs. 1 to 3 the deforming member **38** is in the form of a rigid member extending between the two respiratory units, other arrangements for deformation of the mask may be employed as well, for the sake of forming a chamber **C**. For example, the respective nose/mouth portion **30** may be provided with deforming ribs. Such ribs (not shown) may be integrally molded during the process of molding the hood, e.g. made of silicon, or may be attached thereto by other means, e.g. adhering or welding (e.g. heat or sonic, etc) the ribs may be made of a rigid material other than that of the hood or may constitute an integral part thereof.

Further attention is now directed to Figs. 4-6 for understanding the assembly and mode of operation of the respiratory units **26**. In the present embodiment, each of the respiratory units comprises a multi-receptacle member **48** facing the inside of the protective hood and a cover member **50** facing the outside of the hood. Multi-receptacle member **48** is formed with a plurality of receptacles **54** which in the present example have the shape of a honeycomb and a hexagonal section, though other shapes are possible as well, e.g. circular, etc. Each of the receptacles **54** has an outlet opening **56** which is covered by a fine grid **58**, so as to prevent outflow of the activated charcoal particles recovered within the receptacles **54**. Cover member **50** is similarly formed with a plurality of inlet openings, each such openings fitted with a fine grid **66** also serving to prevent outflow of the activated charcoal particles **59** (seen in Fig. 6) received within the receptacles **54**.

Co-axially received within each respiratory unit **26** there is a one-way exhaling valve **70** which is in the form of a mushroom-type membrane valve with a stem member **72** snapingly received within a central opening formed at the

multi-receptacle member **48**. A plurality of exhaling apertures **74** are formed in the multi-receptacle member **48** to facilitate flow of exhaled gases from the chamber **C** of the protective hood to the surrounding environment, after deforming the mushroom- type valve and then via the outlet apertures **78** formed in the cover member **50**.

Typically, the respiratory units **26** are also fitted with a biologic-material barrier in the form of filtering paper **84** (which for the sake of convenience and practicality is in the form of a single sheet though other arrangements are available as well, e.g. individual pieces received in each of the receptacles **54**).

Whilst in the present example, the receptacles **54** are stuffed with particulated activated charcoal **59** (Fig. 6), it is to be appreciated other forms of gas treating media is possible as well, e.g. uniform or layers of impregnated charcoal cloth or other charcoal carrying media, e.g. particulated charcoal embedded within non woven material, e.g. in the form of pellets, etc.

As can best be seen in Figs. 4 and 6, the size of inlet opening **62** and outlet openings **56** is smaller than the actual size of the receptacles **54**. This arrangement ensures that inflow through the respiratory units is continuously treated and obnoxious material is absorbed by the activated charcoal particles **59** obviating the need for thick filtration material on the one hand and on the other hand, providing extended effective use/filtration.

As can further be seen in Figs. 4 and 6, the receptacle member **92** is formed with an annular rim **90** and the cover member **50** is formed with a corresponding annular rim **94**, the latter provided with gripping teeth **96** at a outward facing portion thereof. The arrangement is such that at the assembled position the circular portion **40** of the deforming member **38** is clampingly received between rim portions **92** and **94**. A retaining ring **100** has a plurality of annular teeth **102** corresponding with teeth **96** of the rim **94** and is adapted for clampingly receiving therebetween respective portions of the hood **12** (Fig. 6) wherein the ring **100** is snapingly secured over the periphery of the cover member **50**.

Reverting now to the issue of chamber **C** formed in the protective hood in accordance with the present invention, as illustrated, for example in Figs. 1 and 2, it is to be appreciated that such a chamber is advantageous as it minimizes the feeling of suffocation in case such a protective hood is stretched over an individual's breathing organisms (nose and mouth). Furthermore, the construction of a chamber (at times referred to as a breathing chamber, mixing chamber, speaking chamber, and other similar terms) enables an individual wearing the protective hood to speak clearly. This is not facilitated in case of a hood which is stretched over the individual's mouth. Still another advantage of the chamber resides in that the individual may breathe freely without having to direct the exhaled gases through an particular outlet opening in which case speech becomes complicated or impossible.